

## **OPERATING THE SOLAR TRITIUM AIRNET SAMPLER**

**Purpose** This Meteorology and Air Quality Group (MAQ) procedure describes the steps to operate the Solar-powered tritium sampler air sampling station used for sampling air for the AIRNET project.

**Scope** This procedure applies to the individuals assigned to operate and maintain the Solar Tritium Air Sampler.

**In this procedure** This procedure addresses the following major topics:

<b>Topic</b>	<b>See Page</b>
General Information About This Procedure	2
Who Requires Training to This Procedure?	2
Setting up the Sampler	3
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**Hazard Control Plan** The hazard evaluation associated with this work is documented in Attachment 1: Initial risk = **low**. Residual risk = **low**. Work permits required: none. First authorization review date is one year from group leader signature below; subsequent authorizations are on file in group office.

**Signatures**

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Work authorized by:  _____ Jean Dewart, MAQ Group Leader	Date:  <u>12/3/03</u>

12/03/03

### **CONTROLLED DOCUMENT**

This copy is uncontrolled if no red stamp is present on printed copies. Users are responsible for ensuring they work to the latest approved revision.

## General information about this procedure

**Attachments** This procedure has the following attachments:

Number	Attachment Title	No. of pages
1	Hazard Control Plan	2
2	Diagram of pump assembly	2

**History of revision** This table lists the revision history and effective dates of this procedure.

Revision	Date	Description of Changes
0	12/4/03	New document.

**Who requires training to this procedure?** The following personnel require training before implementing this procedure:

- MAQ personnel assigned to collect and process AIRNET samples.

**Training method** The training method for this procedure is **on-the-job** training by a previously trained individual and is documented in accordance with the procedure for training (MAQ-024).

**Prerequisites** In addition to training to this procedure, the following training is also required prior to performing this procedure:

- MAQ-011, "Logbook Use and Control"
- MAQ-204, "Sampling of Ambient Airborne Tritium"
- MAQ-205, "Calibration of Air Sampling Stations"
- First Aid
- Cardiopulmonary Resuscitation (CPR)

**References** The following documents are referenced in this procedure:

- MAQ-024, "Personnel Training"
- MAQ-202, "Environmental Sampling of Ambient Airborne Radionuclides"
- MAQ-204, "Sampling of Ambient Airborne Tritium"
- MAQ-205, "Calibration of Air Sampling Stations"
- MAQ-207, "Evaluation of AIRNET Sampler Sites Against Siting Criteria"
- MAQ-217, "Installation of New AIRNET Stations"

## Setting up the sampler

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**Description of system** The Solar Sampler is a battery-powered sampler that will pull air at any rate between 0 and 300 cc per minute. The water vapor sample will be collected using the standard silica cartridge used by the AIRNET project (see MAQ-204). The solar sampler uses up to one solar generator that will recharge the external 12V battery unit and operate the sampler continuously. The flow is controlled by a control panel and total sampler time is recorded by a timer.

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**Siting the sampler** The sampler will generally be used in remote locations where electrical power is not available. The **Air Quality Monitoring Project Leader** will determine the location.

Guidance for siting the station is provided in MAQ-207 (“Evaluation of AIRNET Sampler Sites Against Siting Criteria”). Follow the applicable parts of MAQ-217 (“Installation of New AIRNET Stations”) when moving and locating the sampler housing. **Wear steel-toed shoes** whenever moving the station or the batteries.

For optimum performance, the solar array must face true south and have unobstructed access to the southern sky. Any shading of the modules by trees, buildings, wires, antennas, etc. will substantially reduce the performance of the system, and may cause eventual failure.

Use a magnetic compass to find true south. Be sure to adjust for the magnetic declination in your area (for example, North Central New Mexico, true south is 12 degrees east of magnetic south).

Observe the solar access to the southern sky. If there are obstructions that cannot be removed, try to find another location where the array will not be shaded.

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**Install the control panel in weather housing** Install the solar sampler control panel by bolting it down to the housing. Connect the cable from the solar panels to the Brailsford 12V pump.

## Setting up the sampler, continued

### Battery handling

A sealed type battery should be used to avoid the hazards of a wet battery that contains acid. Sealed batteries may be transported or stored in any position without fear of leakage.

**Wear steel-toed shoes** while carrying batteries. Two people should be used to move batteries.

Do not package batteries with any other materials. During transport, individually box or otherwise secure batteries so that the batteries do not shift or tip. To help prevent accidental shorting of the terminals, label each outer box "Sealed Batteries - This Side Up" with an arrow indicating the top.

### Battery WARNING

USE EXTREME CAUTION WHEN WORKING WITH A BATTERY! DO NOT ALLOW WRENCHES OR OTHER METALLIC OBJECTS TO COME IN CONTACT WITH BOTH TERMINALS SIMULTANEOUSLY- SERIOUS INJURY AND DESTRUCTION OF THE BATTERY MAY OCCUR.

### Equipment needed

Before traveling to the sampler site, collect the following equipment:

- Pre-weighed silica gel cartridge
- Palm computer
- Chain-of-custody form from MAQ-204, or equivalent
- Electrical tools, DC Voltmeter, pliers, and electrical tape.
- 5/16" Straight blade screw driver
- 9/64" Straight blade screw driver
- Combination Wrench Set
- 3/8" Drive Socket Set
- Magnetic Compass
- Housing with control panel
- Solar generator: battery box, battery, standing solar panel

### Steps to set up the sampler

To set up the sampler for a sampling job, perform the following steps:

Step	Action
1	Install weather housing and control panel.
2	Insert the conduit end marked "FLOBOSS" into the appropriate $\frac{3}{4}$ " threaded hole in the battery box enclosure and tighten.

*Steps continued on next page.*

## Setting up the sampler, continued

Step	Action
3	Bond the green equipment ground wire to the common grounding point for the whole system, at the battery box.
4	Terminate the power leads to the pump; RED lead to (+) and BLACK (-). If the load has a plug connector, leave it unplugged until voltage and polarity have been verified below. If it is hard-wired, double check your connections and verify they are correct before proceeding.
<b>Install and connect the battery</b>	
6	Remove the top insulation piece inside the enclosure.
7	Remove the appropriate stickers from the battery label to indicate the month and year of installation. THIS STEP IS VERY IMPORTANT FOR TRACKING BATTERY PERFORMANCE AND WARRANTY INFORMATION.
8	Place the battery into the enclosure with the terminals toward the back. Push it all the way back into the insulation.
9	Remove the nuts from both battery terminal bolts. Connect the RED lead to POSITIVE (+) battery terminal, and then tighten the nut. WARNING: BE CAREFUL WITH THE WRENCH AND THE BATTERY TERMINALS! Slide the rubber boot over the terminal.
10	Repeat Step 9 for the BLACK battery lead and the negative battery terminal. Place the foam piece on the top of the battery.
<b>Wire the module (if not already set up)</b>	
11	Remove the module junction box cover.
12	Remove the plug from the appropriate hole.
13	Remove the strain relief locknut from the cable/conduit end marked "ARRAY" coming from the battery enclosure. Insert the end into the junction box, replace the locknut, and tighten.
14	Terminate the wire ends RED to the POSITIVE (+) terminal and the BLACK to the NEGATIVE (-) terminal, being careful not to over-tighten the screws. Replace cover.
<b>Verify the array connection</b>	
15	Open the battery box door and locate the charger regulator inside near the top. The red "CHARGING" light should be ON. If it is NOT ON, go back and check your connections.
<b>Power up the load</b>	
16	Disconnect (+) battery terminal.
17	Connect wires to pump: red to red, black to grey.
18	Reconnect (+) battery terminal.
19	Use the voltmeter to measure the DC voltage at the charge regulator. Verify correct polarity and a voltage reading of 12 to 14.5 volts DC.
20	Verify that the load has power and is operational.

*Steps continued on next page.*

## Setting up the sampler, continued

Step	Action
<b>Final inspection</b>	
21	Calibrate the flow through the cartridge according to procedure MAQ-205.
22	Check module orientation using the compass; make sure it is facing true south. Verify that there are no obstructions that will shade the module.
23	Check all mounting fasteners for tightness.

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### Set up the sampling parameters

During sampling, the sampler will be run continuously (as the battery charge allows) and the samples will be collected every two weeks during the regular AIRNET sample changeout (see MAQ-202 and –204). If different sampling schedules are called for, follow the schedule specified by the Air Monitoring Project Leader.

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### Changing the filter

Follow the instructions of the Air Monitoring Project Leader for changing the collected tritium samples. Generally, the samples will be collected, labeled, and shipped in the same manner as those collected under procedure MAQ-204.

## Maintenance

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**Maintenance**    The Brailsford pump needs rebuilding every 6 months of use. Obtain a rebuild kit from the manufacturer.

See attachment 2 for rebuilding steps and disassembly diagrams.

## Records resulting from this procedure

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**Records**      There are no records generated as a result of this procedure.



## HAZARD CONTROL PLAN

1. The work to be performed is described in this procedure.

### **“Operating the Solar Tritium AIRNET Sampler”**

2. Describe potential hazards associated with the work (use continuation page if needed).

Falls/tripping – uneven terrain, carrying awkward objects or equipment

Handling heavy objects (loading/unloading/transporting/postioning)

Animal Injuries- (snakes, spiders, mountain lions, etc.)

Weather—Lightning

High Explosives testing (as needed)

Radiation Areas (as needed)

Dropping materials onto feet

Electrical shock

Use of hand tools

3. For each hazard, list the likelihood and severity, and the resulting initial risk level (before any work controls are applied, as determined according to LIR300-00-01, section 7.2)

Falls/tripping –Moderate/Occassional = Minimal

Handling heavy objects (loading/unloading/transporting/postioning)--Moderate/Improbable = Minimal

Animal Injuries- (snakes, spiders, mountain lions, etc.)-Critical/Remote = Minimal

Weather—Lightning—Catastrophic/Remote = Low

High Explosives testing (as needed)--Critical/Remote = Minimal

Radiation Areas (as needed)--Negligible/Remote = Low

Dropping materials onto feet -- Critical/Improbable = Low

Electrical shock -- moderate / improbable = minimal

Injuries from use of hand tools -- moderate/ improbable = minimal

Overall *initial* risk: ☐ Minimal ☒ Low ☐ Medium ☐ High

4. Applicable Laboratory, facility, or activity operational requirements directly related to the work:

☐ None ☒ List:

Work Permits required? ☒ No ☐ List:

Access Control Requirements for applicable areas or FMUs

29 CFR 1926.500, Subpart M, Section 502, "Fall protection"

### HAZARD CONTROL PLAN, continued

5. Describe how the hazards listed above will be mitigated (e.g., safety equipment, administrative controls, etc.):

Falls/tripping – Read the "Employee Orientation" on awareness of trips, slips, and falls.

Handling heavy objects (loading/unloading/transporting/postioning)--Use proper lifting techniques.

Animal Injuries -- Use the "Employee Orientation" training and awareness document and use common sense to avoid these types of injuries.

Weather (lightning) -- Use the "Employee Orientation" training and awareness document and seek shelter when necessary.

Entry into High Explosives testing areas – existings controls are stringent and not easily bypassed.

Existing facility controls include site specific training, sign-in/sign-out, and scheduling procedures.

Entry into posted Radiation/Controlled Areas—Example: TA-54-Area-G and TA-15 controls are stringent and not easily bypassed--Area-G and TA-15 require entry through manned access control gates.

Dropping materials onto feet -- Steel-toed shoes or boots are required anytime pumps, station houses, timbers, or other heavy equipment is moved.

Electrical shock: Voltages are only 12 V. Be aware of sparks, arcs, flashes, and vaporized metal if metal connects the terminals of the battery or if the energized wires touch. Double-check the connection.

Injuries from use of hand tools: use common sense and care.

6. Knowledge, skills, abilities, and training necessary to safely perform this work (check one or both):



Group-level orientation (per MAQ-032) and training to this procedure.



Other → See training prerequisites on procedure page 3. Any additional describe here:

7. Any wastes and/or residual materials? (check one) ☐ None ☒ List:

Used batteries will be recycled in the Laboratory recycling program.

8. Considering the administrative and engineering controls to be used, the *residual* risk level (as determined according to LIR300-00-01.0, section 7.3.3) is (check one):



Minimal



Low



Medium (requires approval by Division Director)

9. Emergency actions to take in event of control failures or abnormal operation (check one):



None



List:

For all trips, falls, burns, cuts, electrical shocks and animal related injuries, provide first aid and see that injured person is taken to HSR-2 or the hospital. Follow all site-specific emergency plans for any radiation or explosives emergencies.

Signature of preparer of this HCP: This HCP was prepared by a knowledgeable individual and reviewed in accordance with requirements in LIR 300-00-01 and LIR 300-00-02.

Preparer(s) signature(s)

Name(s) (print)

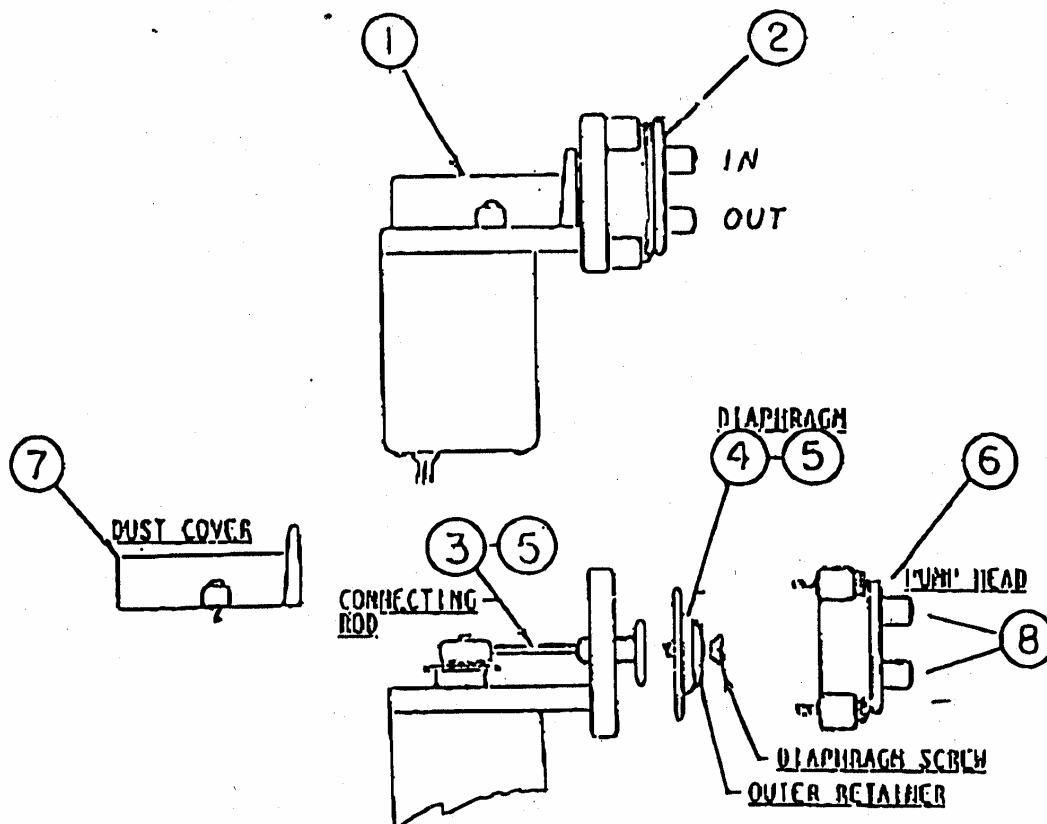
/Position

Date

Signature by group leader on procedure title page signifies authorization to perform work for personnel properly trained to this procedure. This authorization will be renewed annually and documented in MAQ records. Controlled copies are considered authorized. Work will be performed to controlled copies only. This plan and procedure will be revised according to MAQ-022 and distributed according to MAQ-030.

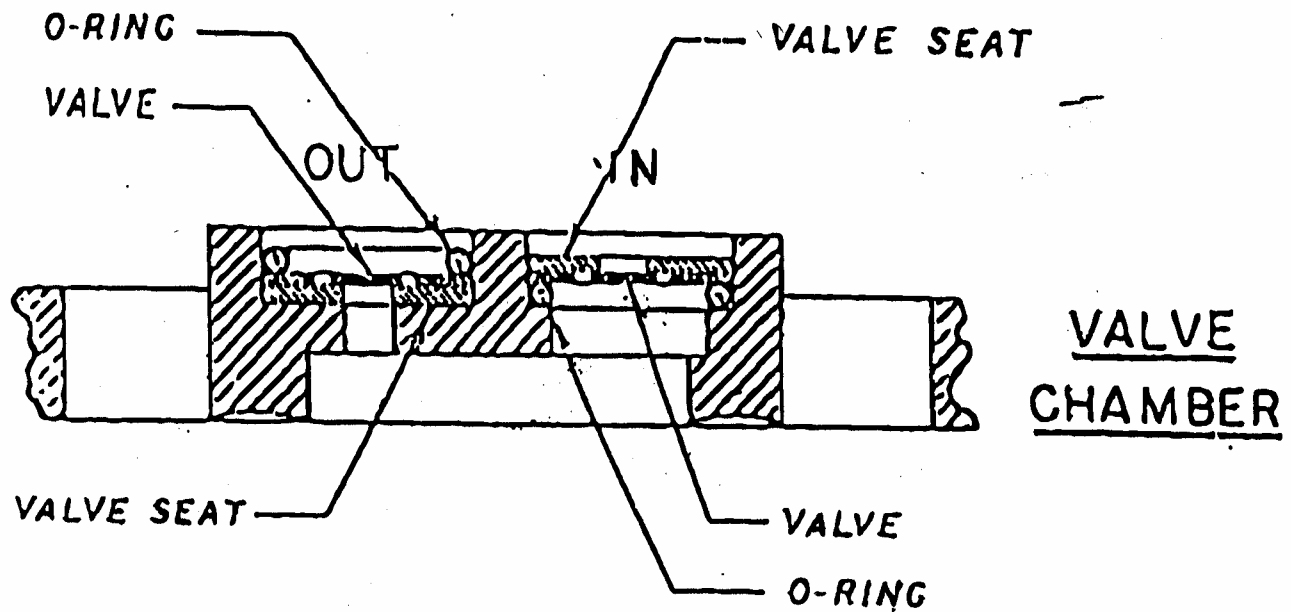
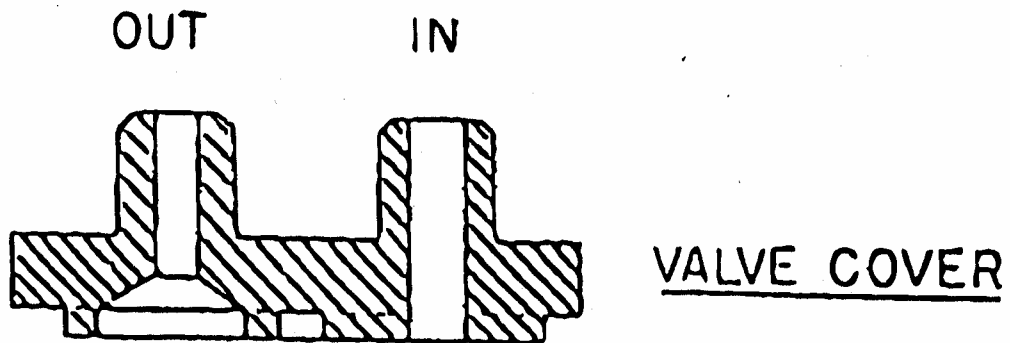
## ATTACHMENT 2

### DIAGRAM OF PUMP ASSEMBLY



- ① UNSCREW TWO PHILLIPS HEAD SCREWS AND REMOVE PLASTIC DUST COVER
- ② UNSCREW FOUR BINDING HEAD SCREWS AND REMOVE PUMP HEAD.
- ③ GRASP CONNECTING ROD WITH FINGERS, AND
- ④ UNSCREW SINGLE FLAT HEAD SCREW TO REMOVE OLD DIAPHRAGM.
- ⑤ GRASP CONNECTING ROD AGAIN, AND INSTALL NEW DIAPHRAGM. NOTE THAT THE LIP ON THE PLASTIC OUTER RETAINER MUST ENGAGE THE CENTER HOLE OF THE DIAPHRAGM. TIGHTEN DIAPHRAGM SCREW.
- ⑥ REINSTALL PUMP HEAD WITH DESIRED ORIENTATION OF THE INLET & OUTLET. INSURE THAT RIM OF DIAPHRAGM IS PROPERLY SEATED IN THE CONCAVE GROOVE IN THE PUMP HEAD. DO NOT TWIST DIAPHRAGM WHEN TIGHTENING THE FOUR PUMP HEAD SCREWS.
- ⑦ REINSTALL DUST COVER.
- ⑧ FORM NEW DIAPHRAGM WITH THE PUMP RUNNING; FOR VACUUM-BY MOMENTARILY BLOCKING INLET PORT; FOR PRESSURE-BY BLOCKING OUTLET PORT.

NOTE THAT PUMP PERFORMANCE CAN BE DEGRADED IF THE PUMP IS ALLOWED TO INGEST FOREIGN MATTER. PUMP HEADS CAN BE DISASSEMBLED AND CLEANED, OR REPLACED. IF PROBLEM CONTINUES, INSTALLATION OF A LOW LOSS INLET FILTER IS SUGGESTED.



NOTE: ASSEMBLE VALVE COMPONENTS IN ORDER SHOWN.  
VALVES MUST LIE FLAT.  
VALVE SURFACES MUST BE CLEAN & FREE OF DEBRIS  
OBSERVE PROPER ORIENTATION OF VALVE COVER WITH  
RESPECT TO VALVE CHAMBER.

